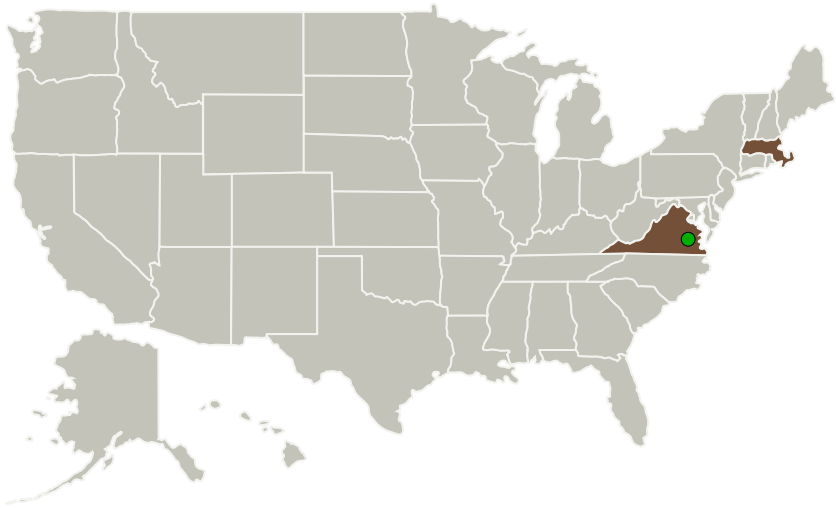
# Adaptive Bio-inspired Navigation for Planetary Exploration, Phase II

Completed Technology Project (2013 - 2016)

## Project Introduction

Exploration of planetary environments with current robotic technologies relies on human control and power-hungry active sensors to perform even the most elementary low-level functions. Ideally, a robot would be able to autonomously explore novel environments, memorize locations of obstacles or objects, learn about objects, build and update an environment map, and return to a safe location. All of these tasks constitute typical activities efficiently performed by animals on a daily basis. The primary objective of the proposed research is to develop a biologically-inspired neuromorphic application that will translate the above-mentioned functionalities into an autonomous robot or unmanned aerial system (UAS). The Phase I effort implemented a neuromorphic system capable of exploring an unknown environment, avoiding obstacles, and returning to base for refuel/recharge without the use of a Global Navigation Satellite System (GNSS). This system was successfully tested in a Mars-like virtual environment and a simple robot. Leveraging Phase I results, the Phase II effort will develop visual processing based on passive sensors in order to find, identify, localize and interact with objects and use this information to enhance navigation capabilities. Neurala's neuromorphic application will also allow for human guidance through an intuitive user interface. Low-power hardware will be evaluated to facilitate real-time performance in robots and unmanned platforms.

## Primary U.S. Work Locations and Key Partners




Adaptive Bio-inspired Navigation for Planetary Exploration, Phase II

## Table of Contents

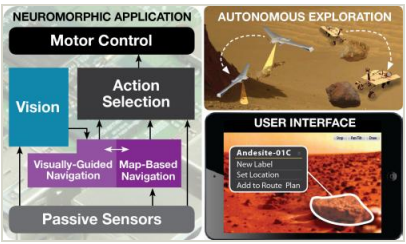
# Adaptive Bio-inspired Navigation for Planetary Exploration, Phase II

Completed Technology Project (2013 - 2016)

| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Neurala LLC | Lead Organization | Industry | South Boston, Massachusetts |
| Langley Research Center(LaRC) | Supporting Organization | NASA Center | Hampton, Virginia |
| Trustees of Boston University | Supporting Organization | Academia | Boston, Massachusetts |

| Primary U.S. Work Locations | |
|---|---|
| Massachusetts | Virginia |

## Images




**Briefing Chart**
Adaptive Bio-inspired Navigation for Planetary Exploration, Phase II *(https://techport.nasa.gov/image/133231)*

## Organizational Responsibility

**Responsible Mission Directorate:**
Space Technology Mission Directorate (STMD)

**Lead Organization:**
Neurala LLC

**Responsible Program:**
Small Business Innovation Research/Small Business Tech Transfer

## Project Management

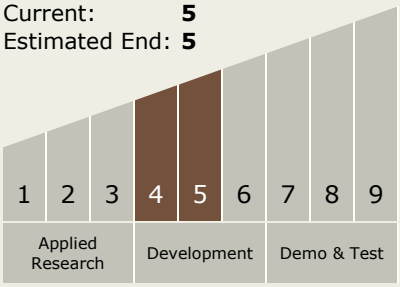
**Program Director:**
Jason L Kessler

**Program Manager:**
Carlos Torrez

**Principal Investigator:**
Anatoly Gorshechnikov

## Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



# Adaptive Bio-inspired Navigation for Planetary Exploration, Phase II

Completed Technology Project (2013 - 2016)

## Technology Areas

**Primary:**

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System